Grid Automation Controller COM600 4.0 IEC 60870-5-103 Master (OPC) User's Manual

Power and productivity
for a better world™

Contents:

1. About this manual 7

1.1. Copyrights 7
1.2. Trademarks 7
1.3. General 7
1.4. Document conventions 8
1.5. Use of symbols 9
1.6. Terminology 9
1.7. Abbreviations 11
1.8. Related documents 12
1.9. Document revisions 12

2. Introduction 13

2.1. Functional overview 13
2.2. IEC 103 OPC Server features 14

3. Configuration 15

3.1. About this section 15
3.2. Overview of configuration 15
3.3. Building object tree 17
3.3.1. General about building object tree 17
3.3.2. Adding Gateway object 18
3.3.3. Adding IEC103 OPC Server object 18
3.3.4. Adding IEC103 Channel objects 18
3.3.5. Adding IEC103 Device objects 18
3.3.6. Adding Logical Device objects 19
3.3.7. Adding Logical Node objects 19
3.3.8. Adding data objects 19
3.4. Configuring objects 19
3.4.1. General about configuring objects 19
3.4.2. IEC103 OPC Server properties 20
3.4.3. Configuring IEC103 Channel properties 21
3.4.4. Configuring IEC103 Device properties 23
3.4.5. Data objects for status information 24
3.4.5.1. General about data objects for status information 24
3.4.5.2. Single point status (SPS) 24
3.4.5.3. Double point status (DPS) 25
3.4.5.4. Integer status (INS) 25
3.4.5.5. Protection activation information (ACT) 26
3.4.5.6. Directional protection activation information (ACD) 27
3.4.5.7. Device name plate (DPL) 28
3.4.5.8. Logical node name plate (LPL) 29
3.4.6. Data objects for measurand information 30

3.4.6.1. General about data objects for measurand information ... 30
3.4.6.2. Measured value (MV) ... 30
3.4.6.3. Complex measured value (CMV) ... 30
3.4.6.4. WYE ... 31
3.4.6.5. Delta (DEL) ... 32
3.4.7. Data objects for controllable status information ... 33
3.4.7.1. General about data objects for controllable status information ... 33
3.4.7.2. Controllable single point (SPC) ... 34
3.4.7.3. Controllable double point (DPC) ... 35
3.4.7.4. Binary controlled step position information (BSC) ... 36

4. Operation ... 38

4.1. About this section ... 38
4.2. Activating COM600 with new configurations ... 38
4.3. IEC103 OPC Server diagnostics ... 38
4.4. Monitoring and controlling IEC103 Channel Activity ... 40
4.5. Monitoring and controlling IEC103 Device communication ... 40
4.6. Data object diagnostics ... 41

5. Technical reference ... 42

5.1. About this section ... 42
5.2. IEC 61850 data modeling ... 42
5.2.1. General about IEC 61850 data modeling ... 42
5.2.2. Data objects for status information ... 42
5.2.2.1. Single point status (SPS) ... 42
5.2.2.2. Double point status (DPS) ... 43
5.2.2.3. Integer status (INS) ... 43
5.2.2.4. Protection activation information (ACT) ... 43
5.2.2.5. Protection activation information (ACD) ... 44
5.2.2.6. Device name plate (DPL) ... 44
5.2.2.7. Logical node name plate (LPL) ... 44
5.2.3. Data objects for measurand information ... 45
5.2.3.1. Measured value (MV) ... 45
5.2.3.2. Complex measured value (CMV) ... 45
5.2.3.3. WYE ... 46
5.2.3.4. Delta (DEL) ... 46
5.2.4. Data objects for controllable status information ... 46
5.2.4.1. Controllable single point (SPC) ... 46
5.2.4.2. Controllable double point (DPC) ... 47
5.2.4.3. Binary controlled step position information (BSC) ... 47
5.3. Attributes ... 48
5.3.1. General about attributes ... 48
5.3.2. Server attributes ... 48

5.3.3. IEC103 Channel attributes 49
5.3.4. IEC103 Device attributes 50
5.4. Status codes 51

Appendix 1 53

Interoperability list for IEC103 OPC Master 53

Index 59

1. About this manual

1.1. Copyrights

The information in this document is subject to change without notice and should not be construed as a commitment by ABB Oy. ABB Oy assumes no responsibility for any errors that may appear in this document.

In no event shall ABB Oy be liable for direct, indirect, special, incidental, or consequential damages of any nature or kind arising from the use of this document, nor shall ABB Oy be liable for incidental or consequential damages arising from use of any software or hardware described in this document.

This document and parts thereof must not be reproduced or copied without written permission from ABB Oy, and the contents thereof must not be imparted to a third party nor used for any unauthorized purpose.

The software or hardware described in this document is furnished under a license and may be used, copied, or disclosed only in accordance with the terms of such license.

© Copyright 2012 ABB. All rights reserved.

1.2. Trademarks

ABB is a registered trademark of ABB Group. All other brand or product names mentioned in this document may be trademarks or registered trademarks of their respective holders.

1.3. General

This manual provides thorough information on the IEC 60870-5-103 Master protocol (later referred to as IEC103 OPC Server) and the central concepts related to it. You find instructions on to take it into use. The basic operation procedures are also discussed.

Information in this user’s manual is intended for application engineers who configure IEC103 OPC Server.

As a prerequisite, you should understand IEC 60870-5-103 protocol and the basic procedures in Station Automation Builder 600 (later referred to as SAB600).

This user’s manual is divided into following sections:

Introduction

This section gives an overview of the IEC103 OPC Server and states the system requirements to be met when using the client.

Configuration

In this section you find an overview of the configuration tasks and instructions on how to create and configure IEC103 OPC Server related objects.

Operation

This section covers the basic operation procedures you can carry out when transferring or activating Grid Automation Controller COM600 (later referred to as COM600) with new configurations.

You are also given instructions on how to monitor and control the IEC103 communication.

Technical reference

This section contains a list of status codes and information about the IEC 61850 data modeling.

1.4. Document conventions

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a window, the label for a field of a dialog box) are initially capitalized.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the ENTER key.
- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the space bar, comma key, and so on.
- Press CTRL+C indicates that you must hold down the CTRL key while pressing the C key (to copy a selected object in this case).
- Press ESC E C indicates that you press and release each key in sequence (to copy a selected object in this case).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
  - The following convention is used for menu operations: **MenuName > MenuItem > CascadedMenuItem**. For example: select **File > New > Type**.
  - The **Start** menu name always refers to the **Start** menu on the Windows taskbar.
- System prompts/messages and user responses/input are shown in the Courier font. For example, if you enter a value out of range, the following message is displayed:

```
Entered value is not valid. The value must be 0 - 30  .
```

- You can be asked to enter the string MIF349 in a field. The string is shown as follows in the procedure:

  MIF349
- Variables are shown using lowercase letters:

  sequence name

1.5. Use of symbols

This publication includes warning, caution, and information icons that point out safety-related conditions or other important information. It also includes tip icons to point out useful information to the reader. The corresponding icons should be interpreted as follows.

The electrical warning icon indicates the presence of a hazard which could result in electrical shock.

The warning icon indicates the presence of a hazard which could result in personal injury.

The caution icon indicates important information or warning related to the concept discussed in the text. It may indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.

The information icon alerts the reader to relevant facts and conditions.

The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

1.6. Terminology

Term	Description
Alarm	An abnormal state of a condition.

Term	Description
Alarms and Events; AE	An OPC service for providing information about alarms and events to OPC clients.
Data Access; DA	An OPC service for providing information about process data to OPC clients.
Data Object; DO	Part of a logical node object representing specific information, for example, status, or measurement. From an object-oriented point of view, a data object is an instance of a class data object. DOs are normally used as transaction objects; that is, they are data structures.
Data Set	The data set is the content basis for reporting and logging. The data set contains references to the data and data attribute values.
Device	A physical device that behaves as its own communication node in the network, for example, protection relay.
Event	Change of process data or an OPC internal value. Normally, an event consists of value, quality, and timestamp.
Intelligent Electronic Device	A physical IEC 61850 device that behaves as its own communication node in the IEC 61850 protocol.
Logical Device; LD	Representation of a group of functions. Each function is defined as a logical node. A physical device consists of one or several LDs.
Logical Node; LN	The smallest part of a function that exchanges data. An LN is an object defined by its data and methods.
LON	A communication protocol developed by Echelon.
LON Application Guideline for substation automation; LAG	A proprietary method of ABB on top of the standard LON protocol.
OPC	Series of standards specifications aiming at open connectivity in industrial automation and the enterprise systems that support industry.
OPC item	Representation of a connection to the data source within the OPC server. An OPC item is identified by a string <object path>:<property name>. Associated with each OPC item are Value, Quality, and Time Stamp.
Property	Named data item.
Report Control Block	The report control block controls the reporting processes for event data as they occur. The reporting process continues as long as the communication is available.
SPA	ABB proprietary communication protocol used in substation automation.
SPA device	Protection and/or Control Product supporting the SPA protocol version 2.5 or earlier.
Substation Configuration Language; SCL	XML-based description language for configurations of electrical substation IEDs. Defined in IEC 61850 standard.

1.7. Abbreviations

Abbreviation	Description
AE	Alarms and Events
ASDU	Application Service Data Unit
BRCB	Buffered Report Control Block
DA	Data Access
DMCD	Data Message Code Definition
DO	Data Object
GW	Gateway, component connecting two communication networks together
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
LAG	LON Application Guideline for substation automation
LAN	Local Area Network
LD	Logical Device
LMK	LonMark interoperable device communicating in LonWorks network. In this document, the term is used for devices that do not support the ABB LON/LAG communication.
LN	Logical Node
LSG	LON SPA Gateway
NCC	Network Control Center
NUC	Norwegian User Convention
NV	Network Variable
OLE	Object Linking and Embedding
OPC	OLE for Process Control
P&C	Protection & Control
PLC	Programmable Logic Controller
POU	Program Organization Unit
RTS	Request To Send
SA	Substation Automation
SCD	Substation Configuration Description
SCL	Substation Configuration Language
SFC	Sequential Function Chart
SLD	Single Line Diagram
SNMP	Simple Network Management Protocol

Abbreviation	Description
SNTP	Simple Network Time Protocol
SOAP	Simple Object Access Protocol
RCB	Report Control Block
URCB	Unbuffered Report Control Block
XML	eXtended Markup Language

1.8. Related documents

Name of the manual	MRS number
COM600 User’s Manual	1MRS756125
COM600 HMI Configuration Manual	1MRS756740

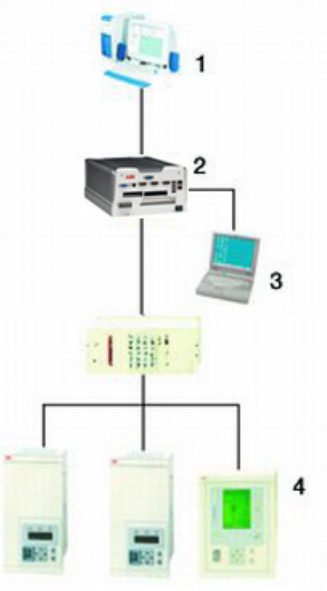
1.9. Document revisions

Document version/date	Product revision	History
A/30.6.2004	1.0	Document created
B/16.10.2006	3.0	Document revised
C/21.12.2007	3.1	Document revised
D/17.6.2008	3.2	Document revised
E/13.2.2009	3.3	Document revised
F/06.11.2009	3.4	Document revised
G/30.6.2011	3.5	Document revised
H/31.5.2012	4.0	Document revised

2. Introduction

2.1. Functional overview

The IEC103 OPC Server provides methods for OPC clients to exchange data with devices communicating via the IEC 60870-5-103 Master protocol.



IEC_103_Master_protocol_a.jpg

Figure 2.1-1 IEC 103 OPC Server system overview

(1) NCC (Network Control Center)

(2) COM600 with IEC103 OPC Server

(3) Station Automation Builder 600 (SAB600)

(4) Protection and control devices communicating through the IEC 60870-5-103 Master Protocol

The IEC103 OPC Server software has two parts: Engineering and diagnostic tools and the actual IEC103 OPC Server. Engineering and diagnostic tools utilize the Station Automation Builder 600 (later referred to as SAB600) framework and provide the user interface for engineering and diagnosing the IEC103 OPC Server. The IEC103 OPC Server handles the data transfer and conversion between the IEC103 protocol and OPC interfaces.

To create a common and protocol independent data interface between the OPC server and client, the process data from the IEC103 devices is remodeled using the IEC 61850 data modeling.

The configuration data is stored in the SCL format. After the IEC103 OPC Server has been launched, it reads the configuration file and establishes communication with the IEC103 devices through the IEC103 protocol stack.

Configured IEC103 devices and data modeled according to the IEC 61850 model (see 5.2.1, General about IEC 61850 data modeling) are then exposed to OPC clients through a Data Access (DA) server.

2.2. IEC 103 OPC Server features

The IEC 103 OPC Server supports the following features:

- OPC Data Access v. 1.0/2.0
- OPC Alarms and Events specifications v. 1.10
- IEC 61850 data modeling
- System supervision:
  - IEC103 channel communication
  - IEC103 device communication
- Supported IEC103 data types and functions:
  - Event-based indications
  - Event based and cyclically updated measurements
  - General commands
  - Time synchronization

3. Configuration

3.1. About this section

This section guides you in the configuration tasks required before you can start using the IEC103 OPC Server. For information on the IEC 61850 data modeling, refer to COM600 User's Manual.

Start SAB600 to open and name a project.

1. Select **File > Open/Manage Project...**.
2. In the Open/Manage Project dialog, select the required location for the project:
   - Projects on my computer
   - Projects on network
3. Select **New Project** on the left.
   - Enter a Project Name. The Description is optional.
4. Click **Create**.
5. Click **Open Project**.

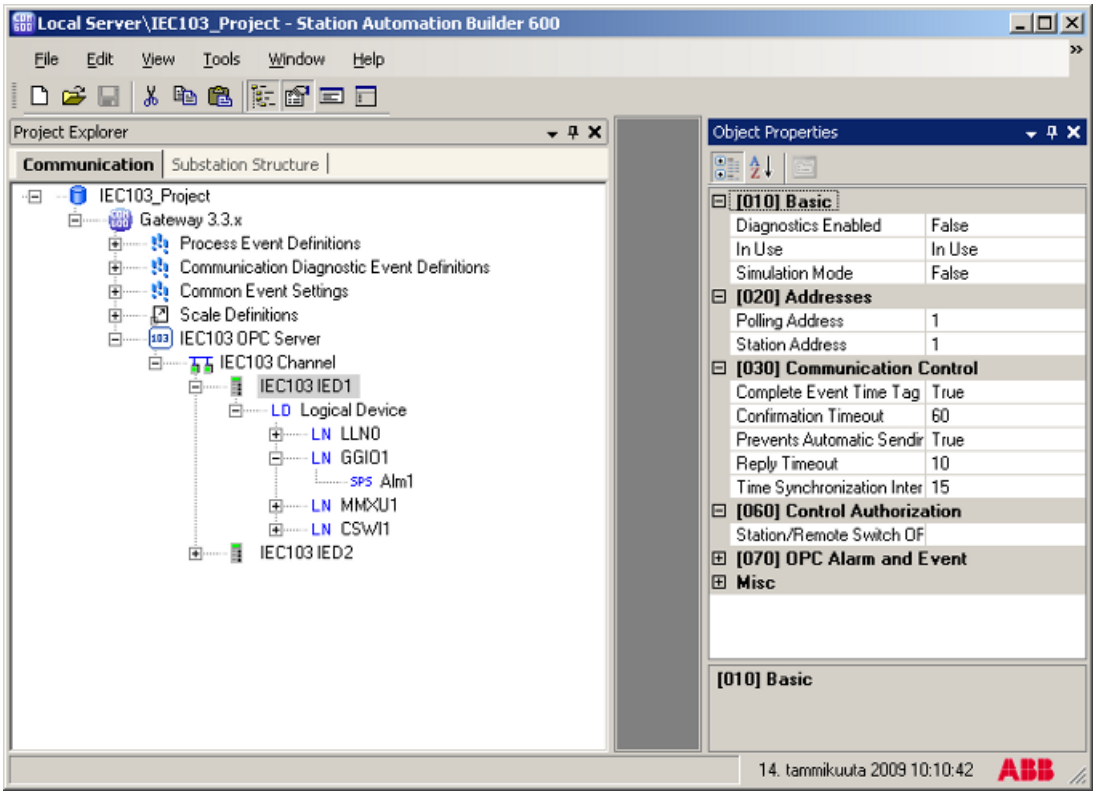
3.2. Overview of configuration

Before you can start using the IEC103 OPC Server, you need to build and configure an object tree in SAB600 to define the Communication structure.

The possible objects are:
- Gateway
- IEC103 OPC Server
- IEC103 Channel
- IEC103 IED
- Logical Device objects
- Logical Node objects
- Data objects

Figure 3.2-1 shows an example view of SAB600 including an object tree in the communication structure on the left and Object Properties window displaying the object properties on the right.

When configuring OPC servers the following characters cannot be used in object names: \ ` ' ' #



IEC103_configuration_overview.bmp

Figure 3.2-1 Example view of SAB600

The configuration work can basically be divided into two separate tasks:
1. building an object tree, and
2. configuring object properties.

First, you need to build an object tree. This is done by adding objects to the object tree, see 3.3.1, General about building object tree . Connectivity Packages for certain Protection and Control products usually contain preconfigurations and tools to facilitate the building of the object tree.

Figure 3.2-1 shows an example of how the object tree may look like after it has been built. In the example tree you can see the IEC103 OPC Server object and its child objects like channels, devices, and data objects. Indentation is used to indicate the parent-child relationship between the objects.

After you have added the necessary objects to the object tree in the communication structure, you need to configure them, see 3.4.1, General about configuring objects.

Table 3.2-1 describes the objects shown in the object tree (Figure 3.2-1).

Table 3.2-1 IEC103 Server related objects

Object	Description
IEC103 OPC Server	An object representing the IEC103 OPC Server.
IEC103 Channel	An object representing a physical communication channel. You can define up to three channels per OPC server.
IEC103 IED	An object representing a physical device. You should not have more than 30 devices per each channel.
Logical Device (LD)	An object representing a group of functions. Each function is defined as a Logical Node. A physical device consists of one or several LDs.
Logical Node (LN)	An object defined by its data and methods. LN is the smallest part of a function that exchanges data.
Data Object (DO)	Data object is an instance of one of the IEC 61850 Data Object Classes such as Single point status and Measured Value. Depending on the class, each data object has a set of attributes for monitoring and controlling the object, e.g. value, quality, and control.

3.3. Building object tree

3.3.1. General about building object tree

The object tree is built in the Communication structure of SAB600, see Figure 3.2-1. It is built by adding objects in a logical order starting from the Gateway.

You have several possible ways to add objects to the object tree:
- You can right-click the object to which you want to add a child object. Select **New > Object type group > Object name** , for example **New > IEC103 > IEC103 > IED**.
- You can right-click the object type and select **New > New**. A New Object window appears. Select the object type you want to add and click **OK** or double-click it.
- You can copy the object.

Add the objects in the following order:
1. Gateway
2. IEC103 OPC Server
3. IEC103 Channel
4. IEC103 Device
5. Logical Device objects
6. Logical Node objects
7. Data objects

For information on building a substation structure, refer to COM600 HMI Configuration Manual.

3.3.2. Adding Gateway object

To start building the object tree, add a Gateway object in the Communication structure by selecting the project name, right-click it and select **New > Communication > Gateway**.

3.3.3. Adding IEC103 OPC Server object

After the Gateway object has successfully been added, you can continue building the object tree by adding an IEC103 OPC Server object.

To add an IEC103 OPC Server object:
1. Select the Gateway object in the communication structure and right-click it.
2. Add an IEC103 OPC Server object.

By using the SCL Import function, it is possible to import an entire server’s or individual device's configurations without having to insert them manually. To open the SCL Import function, right-click the desired object, and select **SCL Import**.

For more information about the SCL Import function, see COM600 User's Manual.

Connectivity Packages for certain protection and control devices can also support other ways to build this structure, depending on the configuration of an individual device, for example device-related object types and wizards. Typically, Connectivity Packages include SCL description files which must be installed. For further information on these Connectivity Packages, see the Connectivity Package of a certain device in the product documentation.

3.3.4. Adding IEC103 Channel objects

To add an IEC103 Channel object:
1. Select an IEC103 OPC Server object and right-click it.
2. Add an IEC103 Channel object.
3. Rename the new object. The names of the IEC103 Channels have to be unique.

3.3.5. Adding IEC103 Device objects

To add an IEC103 Device object:
1. Select an IEC103 Channel object and right-click it.
2. Add an IEC103 Device object.
3. Rename the new object. The names of the IEC103 Devices within an IEC103 OPC Server have to be unique.

3.3.6. Adding Logical Device objects

To add a Logical Device object:
1. Select an IEC103 Device object and right-click it.
2. Add a Logical Device object.
3. Rename the new object. The names of the Logical Device objects have to be unique.

Each IEC103 physical device must have at least one Logical Device object as a child object.

3.3.7. Adding Logical Node objects

To add a Logical Node:
1. Select a Logical Device object and right-click it.
2. Add a Logical Node object.
3. Rename the new object. The names of the Logical Node objects have to be unique.

You should have only one Logical Node 0 (LLN0) as a child object to a Logical Device object.

3.3.8. Adding data objects

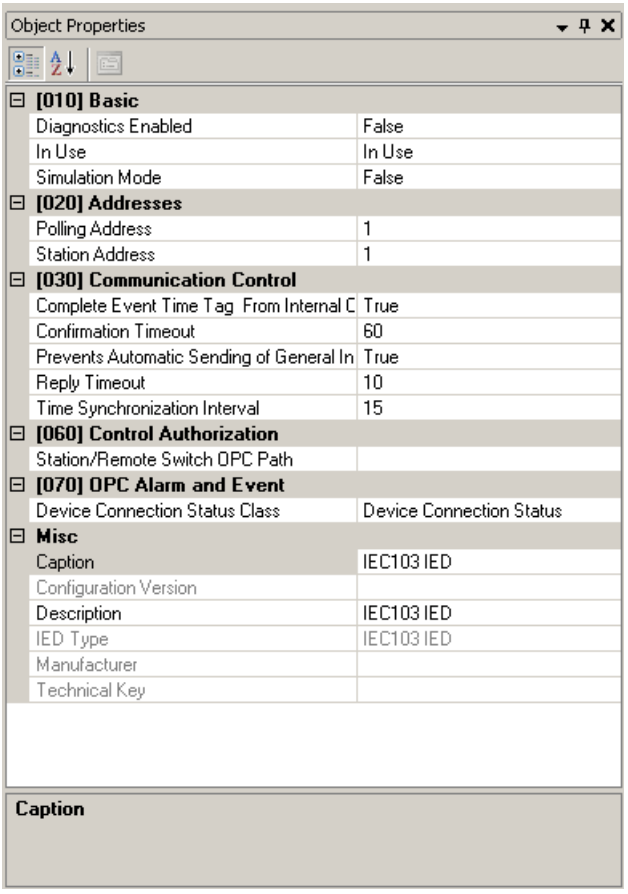
To add a data object:
1. Select a Logical Node object and right-click it.
2. Add a data object.
3. Rename the new object. The names of the data objects have to be unique.

3.4. Configuring objects

3.4.1. General about configuring objects

After the objects have been added, configure the object properties. Figure 3.4.1-1 shows an example of how to use SAB600 to configure the object properties for IEC103 Device.

To configure an object:
1. Select an object in the object tree of the communication structure.
   - The object properties appear now in the Object Properties window. The properties and their values can be viewed as shown in Figure 3.4.1-1.



IEC103_Obj_Prop.bmp

Figure 3.4.1-1 Example of object properties in the Objects Properties window

2. Select the property you want to configure. Depending on the property value type, configuring is always done either by
   - selecting a predefined value from a drop-down menu, or
   - entering a text string or a numerical value in a text field.

The available properties for different objects are listed in the following subsections.

3.4.2. IEC103 OPC Server properties

Table 3.4.2-1 lists the IEC103 OPC Server properties, their value ranges, defaults, and descriptions. These properties are not configurable.

Table 3.4.2-1 IEC103 OPC Server properties

Name	Value or Value range/ Default	Description
Basic		
AE Prog ID	Default: None	Prog ID for OPC Alarm and Event Server
DA Prog ID	Default: None	Prog ID for OPC Data Access Server

3.4.3. Configuring IEC103 Channel properties

The IEC103 Channel properties that can be configured and value ranges for them can be found in Table 3.4.3-1. The actual configuration by using SAB600 is performed as described in 3.4.1, General about configuring objects.

Table 3.4.3-1 IEC103 Channel properties

Name	Value or Value range/ Default	Description
Basic		
In Use	In Use Not In Use Default: In Use	Controls whether the device communication is initially in use or not.
Communication Port		
Bit Rate	300 bits/s 600 bits/s 1200 bits/s 2400 bits/s 4800 bits/s 9600 bits/s 19200 bits/s Default: 19200 bits/s	Transmission rate used on the line
Communication Port	COM1...COM4 Default: COM1	Serial port used by the IEC 60870-5-103 protocol
Parity	No parity check Odd parity Even parity Default: No parity check	Specifies the used parity check.
Communication Control		
Carrier Blocking	Carrier Detect ignored Carrier Detect must be set Default: Carrier Detect must be set	Usage of DCD signal of the serial port
CTS Delay	1...65535 Default: 50	CTS waiting delay in milliseconds
Header Timeout	0...65535 Default: 2000	Maximum waiting time of a link layer response in milliseconds
Ignore the DFC bit	True False Default: False	Ignore the DFC bit. If true, master continues polling normally. If false, master sends the ‘request status of link’ until the remote station clears the DFC bit.

Name	Value or Value range/ Default	Description
Receiver Interrupt Delay	0...255 Default: 0	Delay of the receiving activation in milli-seconds
Response Timeout	0...65535 Default: 2	Maximum waiting time of a link layer response in seconds
RTS Keep Up	0...255 Default: 0	RTS keep up padding characters
RTS Keep Up Delay	0...20 Default: 1	Keep up delay of the RTS
Time Synchroniza-tion Interval	0...65535 Default: 15	Time synchronization interval in seconds
Transmission Wait Delay	0...65535 Default: 0	Transmission wait delay after given CTS in milliseconds
Polling		
Enquiry Limit	0...255 Default: 3	Number of times that a message is retransmitted.
One link, one station poll	True False Default: False	One link, one station poll. If true, master infinitely polls the first link which responds (typically used with dial-up). If false, all the links are polled normally.
Polling Delay	0...65535 Default: 50	Delay between polling messages in milli-seconds
Polling Limit	2...100 Default: 10	Limits the number of successive polls of a device.
Polling Period	1...255 Default: 10	The polling frequence of a suspended station
Reply Poll Count	1...20 Default: 10	The reply polling specifies the number of successive polls to a station where a command has been sent.
Secondary Polling Limit	0...100 Default: 0	Limits the number of successive class 2 polls of a device. The value must be smaller than the value of Polling Lmit.

3.4.4. Configuring IEC103 Device properties

Table 3.4.4-1 lists the value ranges and/or default values for the IEC103 Device properties that you can define. The actual configuration by using SAB600 is performed as described in 3.4.1, General about configuring objects.

Table 3.4.4-1 IEC103 Device properties

Name	Value or Value range/ Default	Description
Basic		
Diagnostics Enabled	True False Default: False	Specifies whether diagnostic AE events are sent for the device.
In Use	In Use Not In Use Default: In Use	Controls whether the device communication is initially in use or not.
Simulation Mode	True False Default: False	Specifies whether the device is in simulation mode or not.
Addresses		
Polling Address	0...255 Default: 1	Station polling address
Station Address	0...255 Default: 1	Common address of ASDU
Communication Control		
Complete Event Time Tag From Internal Clock	True False Default: True	Completion of event time tag by adding year, date, and hour. If true, event time tags are completed based on the internal clock of the master. If false, time tags are completed based on clock information sent by the slave.
Confirmation Timeout	0...255 Default: 60	Command confirmation timeout in seconds
Prevents Automatic Sending of General Interrogation	True False Default: True	Sending of general interrogation. If true, GI is not sent. If false, GI is sent always when communication is (re)established successfully.
Reply Timeout	0...255 Default: 10	Link layer command acknowledgment timeout in seconds

Name	Value or Value range/ Default	Description
Time Synchronization Interval	0...65535 Default: 15	Time synchronization interval in seconds
Control Authorization		
Station/Remote Switch OPC Path	Default: None	OPC path of the station remote switch position is used with this device. The format is Node#ProgID For OPC Server#Channel Name\IED Name\Logical Device Name\Logical Node Name\Data Object Name e.g. GW#ABB.IEC103_OPC_DA_Server.Instance[1]#Channel1\IED1\LD1\GGIO1\loc
OPC Alarm and Event		
Device Connection status Class	Default: Device Connection Status	Device connection status class definition used with current device.

3.4.5. Data objects for status information

3.4.5.1. General about data objects for status information

There are seven different data objects providing status information:

- 3.4.5.2, Single point status (SPS)
- 3.4.5.3, Double point status (DPS)
- 3.4.5.4, Integer status (INS)
- 3.4.5.5, Protection activation information (ACT)
- 3.4.5.6, Directional protection activation information (ACD)
- 3.4.5.7, Device name plate (DPL)
- 3.4.5.8, Logical node name plate (LPL)

The parameters are stored in Object Properties of SAB600, see the tables for each data object type. The actual configuration using SAB600 is performed as described in 3.4.1, General about configuring objects.

3.4.5.2. Single point status (SPS)

Table 3.4.5.2-1 Configurable SPS properties for OPC servers

Property/Parameter	Value or Value range/ Default	Description
Basic		

Property/Parameter	Value or Value range/ Default	Description
Common Data Class	SPS	Common data class according to IEC 61850
Addresses		
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Information Number	0...255 Default: 105	IEC103 indication information number
Scale and Unit		
Scale	Default: None	Scale to be used with this data object

3.4.5.3. Double point status (DPS)

Table 3.4.5.3-1 Configurable DPS properties for OPC servers

Property/Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPS	Common data class according to IEC 61850
Addresses		
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Information Number	0...255 Default: 105	IEC103 indication information number
Scale and Unit		
Scale	Default: None	Scale to be used with this data object

3.4.5.4. Integer status (INS)

Table 3.4.5.4-1 Configurable DPS properties for OPC servers

Property/ Parameter	Value or Value range / Default	Description
Basic		
Common Data Class	INS	Common data class according to IEC 61850

Property/ Parameter	Value or Value range / Default	Description
Addresses		
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Index	1...255 Default: 1	IEC103 indication index
Indication Information Number	0...255 Default: 105	IEC103 indication information number
Scale and Unit		
Scale	Default: None	Scale to be used with this data object

3.4.5.5. Protection activation information (ACT)

Table 3.4.5.5-1 Configurable ACT properties for OPC servers

Property/Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACT	Common data class according to IEC 61850
General Addresses		
General Function Type	0...255 Default: 160	IEC103 function type for general
General Information Number	0...255 Default: 144	IEC103 information number for general
Phase A Addresses		
Phase A Function Type	0...255 Default: 160	IEC103 function type for phase A
Phase A Information Number	0...255 Default: 144	IEC103 information number for phase A
Phase B Addresses		
Phase B Function Type	0...255 Default: 160	IEC103 function type for phase B

Property/Parameter	Value or Value range/ Default	Description
Phase B Information Number	0...255 Default: 144	IEC103 information number for phase B
Phase C Addresses		
Phase C Function Type	0...255 Default: 160	IEC103 function type for phase C
Phase C Information Number	0...255 Default: 144	IEC103 information number for phase C
Neutral Addresses		
Neutral Function Type	0...255 Default: 160	IEC103 function type for neutral
Neutral Information Number	0...255 Default: 144	IEC103 information number for neutral

3.4.5.6. Directional protection activation information (ACD)

Table 3.4.5.6-1 Configurable ACD properties for OPC servers

Property/Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	ACD	Common data class according to IEC 61850
General Addresses		
General Function Type	0...255 Default: 160	IEC103 function type for general
General Information Number	0...255 Default: 144	IEC103 information number for general
Phase A Addresses		
Phase A Function Type	0...255 Default: 160	IEC103 function type for phase A
Phase A Information Number	0...255 Default: 144	IEC103 information number for phase A

Property/Parameter	Value or Value range/ Default	Description
Phase B Addresses		
Phase B Function Type	0...255 Default: 160	IEC103 function type for phase B
Phase B Information Number	0...255 Default: 144	IEC103 information number for phase B
Phase C Addresses		
Phase C Function Type	0...255 Default: 160	IEC103 function type for phase C
Phase C Information Number	0...255 Default: 144	IEC103 information number for phase C
Neutral Addresses		
Neutral Function Type	0...255 Default: 160	IEC103 function type for neutral
Neutral Information Number	0...255 Default: 144	IEC103 information number for neutral

3.4.5.7. Device name plate (DPL)

Table 3.4.5.7-1 Configurable DPL properties for OPC servers

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPL	Common data class according to IEC 61850
Addresses		
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Information Number	0...255 Default: 105	IEC103 indication information number
Vendor		
Vendor	Default: ABB	A simple textstring, describing the vendor.
Hardware Revision		

Property/ Parameter	Value or Value range/ Default	Description
Hardware Revision	Default: 0	A simple textstring, describing the hardware revision.
Software Revision		
Software Revision	Default: 0	A simple textstring, describing the software revision.
Serial Number		
Serial Number	Default: 0	A simple textstring, describing the serial number.
Location		
Location	Default: 0	A simple textstring, describing the location.

3.4.5.8. Logical node name plate (LPL)

Table 3.4.5.8-1 Configurable LPL properties for the OPC servers

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	LPL	Common data class according to IEC 61850
Addresses		
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Information Number	0...255 Default: 105	IEC103 indication information number
Vendor		
Vendor	Default: ABB	A simple textstring, describing the vendor.
Software Revision		
Software Revision	Default: 0	A simple textstring, describing the software revision.
Description		
Description	Default: 0	A simple textstring, describing the description for logical node.

3.4.6. Data objects for measurand information

3.4.6.1. General about data objects for measurand information

There are four different data objects providing measurand information:

- 3.4.6.2, Measured value (MV)
- 3.4.6.3, Complex measured value (CMV)
- 3.4.6.4, WYE
- 3.4.6.5, Delta (DEL)

The parameters are stored in Object Properties of SAB600, see the tables for each data object type. The actual configuration using SAB600 is performed as described in 3.4.1, General about configuring objects.

3.4.6.2. Measured value (MV)

Table 3.4.6.2-1 Configurable MV properties for OPC servers

Property/ Parameter	Value or Value range / Default	Description
Basic		
Common Data Class	MV	Common data class according to IEC 61850
Addresses		
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Index	1...255 Default: 1	IEC103 indication index
Indication Information Number	0...255 Default: 105	IEC103 indication information number
Scale and Unit		
Scale	Default: None	Scale to be used with this data object

3.4.6.3. Complex measured value (CMV)

Table 3.4.6.3-1 Configurable CMV properties for OPC servers

Property/ Parameter	Value or Value range / Default	Description
Basic		

Property/ Parameter	Value or Value range / Default	Description
Common Data Class	CMV	Common data class according to IEC 61850
Addresses		
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Index	1...255 Default: 1	IEC103 indication index
Indication Information Number	0...255 Default: 105	IEC103 indication information number
Scale and Unit		
Scale	Default: None	Scale to be used with this data object

3.4.6.4. WYE

Table 3.4.6.4-1 Configurable WYE properties for OPC servers

Property/Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	WYE	Common data class according to IEC 61850
Phase A Addresses		
Phase A Function Type	0...255 Default: 160	IEC103 function type for phase A
Phase A Index	1...255 Default: 1	IEC103 index for phase A
Phase A Information Number	0...255 Default: 144	IEC103 information number for phase A
Phase B Addresses		
Phase B Function Type	0...255 Default: 160	IEC103 function type for phase B
Phase B Index	1...255 Default: 2	IEC103 index for phase B

Property/Parameter	Value or Value range/ Default	Description
Phase B Information Number	0...255 Default: 144	IEC103 information number for phase B
Phase C Addresses		
Phase C Function Type	0...255 Default: 160	IEC103 function type for phase C
Phase C Index	1...255 Default: 3	IEC103 index for phase C
Phase C Information Number	0...255 Default: 144	IEC103 information number for phase C
Neutral Addresses		
Neutral Function Type	0...255 Default: 160	IEC103 function type for neutral
Neutral Index	1...255 Default: 4	IEC103 index for neutral
Neutral Information Number	0...255 Default: 144	IEC103 information number for neutral
Scale and Unit		
Neutral Scale	Default: None	Scale to be used with neutral for this data object
Phase Scale	Default: None	Scale to be used with phases for this data object

3.4.6.5. Delta (DEL)

Table 3.4.6.5-1 Configurable DEL properties for OPC servers

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DEL	Common data class according to IEC 61850
Phase AB Addresses		

Property/ Parameter	Value or Value range/ Default	Description
Phase AB Function Type	0...255 Default: 160	IEC103 function type for phase AB
Phase AB Index	1...255 Default: 1	IEC103 index for phase AB
Phase AB Information Number	0...255 Default: 144	IEC103 information number for phase AB
Phase BC Addresses		
Phase BC Function Type	0...255 Default: 160	IEC103 function type for phase BC
Phase BC Index	1...255 Default: 2	IEC103 index for phase BC
Phase BC Information Number	0...255 Default: 144	IEC103 information number for phase BC
Phase CA Addresses		
Phase CA Function Type	0...255 Default: 160	IEC103 function type for phase CA
Phase CA Index	1...255 Default: 3	IEC103 index for phase CA
Phase CA Information Number	0...255 Default: 144	IEC103 information number for phase CA
Scale and Unit		
Phase Scale	Default: None	Scale to be used with phases with this data object

3.4.7. Data objects for controllable status information

3.4.7.1. General about data objects for controllable status information

There are three different data objects providing controllable status information:

- 3.4.7.2, Controllable single point (SPC)
- 3.4.7.3, Controllable double point (DPC)
- 3.4.7.4, Binary controlled step position information (BSC)

The parameters are stored in Object Properties of SAB600, see the tables for each data object type. The actual configuration using SAB600 is performed as described in 3.4.1, General about configuring objects.

3.4.7.2. Controllable single point (SPC)

Table 3.4.7.2-1 Configurable SPC properties for OPC servers

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	SPC	Common data class according to IEC 61850
Subtype of the current data object: Same command and indication addresses		
Addresses		
Command ASDU Type	0...255 Default: 20	IEC103 command ASDU type
Command Function Type	0...255 Default: 101	IEC103 command function type
Command Information Number	0...255 Default: 105	IEC103 command information number
Subtype of the current data object: Separate command and indication addresses		
Addresses		
Command ASDU Type	0...255 Default: 20	IEC103 command ASDU type
Command Function Type	0...255 Default: 101	IEC103 command function type
Command Information Number	0...255 Default: 105	IEC103 command information number
Indication Function Type	0...255 Default: 101	IEC103 indication function type

Property/ Parameter	Value or Value range/ Default	Description
Indication Information Number	0...255 Default: 105	IEC103 indication information number

3.4.7.3. Controllable double point (DPC)

Table 3.4.7.3-1 Configurable DPC properties for OPC servers

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	DPC	Common data class according to IEC 61850
Subtype of the current data object: Same command and indication addresses		
Addresses		
Command ASDU Type	0...255 Default: 20	IEC103 command ASDU type
Command Function Type	0...255 Default: 101	IEC103 command function type
Command Information Number	0...255 Default: 105	IEC103 command information number
Subtype of the current data object: Separate command and indication addresses		
Addresses		
Command ASDU Type	0...255 Default: 20	IEC103 command ASDU type
Command Function Type	0...255 Default: 101	IEC103 command function type
Command Information Number	0...255 Default: 105	IEC103 command information number

Property/ Parameter	Value or Value range/ Default	Description
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Information Number	0...255 Default: 105	IEC103 indication information number

3.4.7.4. Binary controlled step position information (BSC)

Table 3.4.7.4-1 Controllable BSC properties for OPC servers

Property/ Parameter	Value or Value range/ Default	Description
Basic		
Common Data Class	BSC	Common data class according to IEC 61850
Subtype of the current data object: Same command and indication addresses		
Addresses		
Command ASDU Type	0...255 Default: 20	IEC103 command ASDU type
Command Function Type	0...255 Default: 101	IEC103 command function type
Command Information Number	0...255 Default: 105	IEC103 command information number
Scale and Unit		
Scale	Default: None	Scale to be used with this data object
Subtype of the current data object: Separate command and indication addresses		
Addresses		
Command ASDU Type	0...255 Default: 20	IEC103 command ASDU type

Property/ Parameter	Value or Value range/ Default	Description
Command Function Type	0...255 Default: 101	IEC103 command function type
Command Information Number	0...255 Default: 105	IEC103 command information number
Indication Function Type	0...255 Default: 101	IEC103 indication function type
Indication Index	1...255 Default: 1	IEC103 indication index
Indication Information Number	0...255 Default: 105	IEC103 indication information number
Scale and Unit		
Scale	Default: None	Scale to be used with this data object

4. Operation

4.1. About this section

This section describes the basic operation procedures you can carry out after the IEC103 OPC Server has been configured.

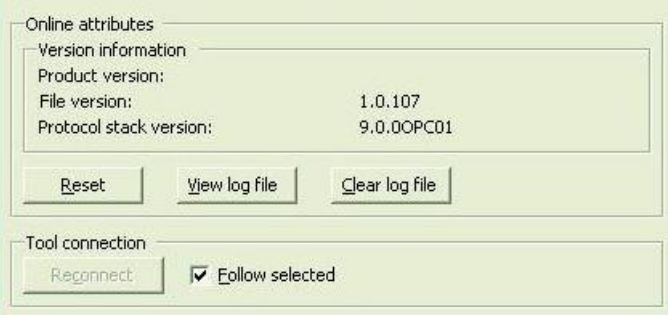
After this, you can, for example, monitor and control the condition of connections in an IEC103 network. This is done by using the Online diagnostics function in SAB600.

4.2. Activating COM600 with new configurations

For information about activating COM600 with new configuration, see COM600 User's Manual.

4.3. IEC103 OPC Server diagnostics

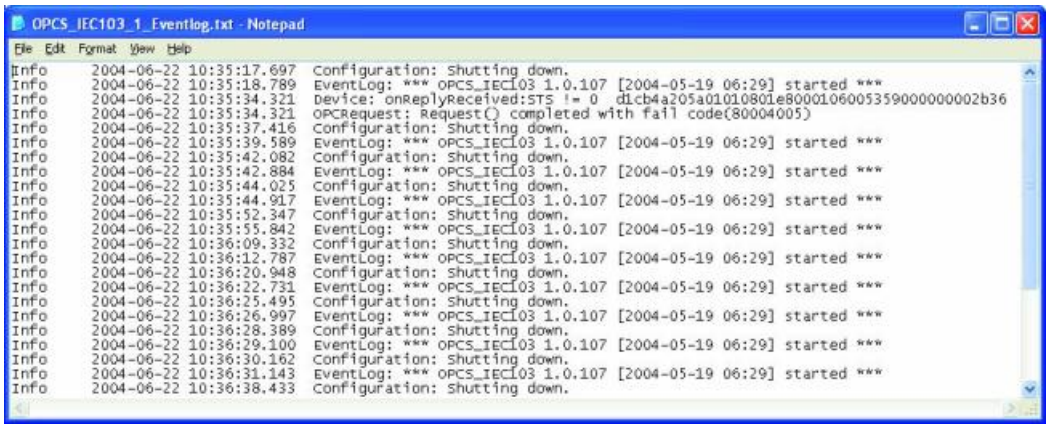
To view the IEC103 OPC Server diagnostics, right-click the IEC103 OPC Server object and select **Online diagnostics** , see Figure 4.3-1 .



IEC103_OPC_Server_Online_diagnostics.jpg

Figure 4.3-1 IEC103 OPC Server Online diagnostics

You have the following alternatives:
- to view version information
- to reset the IEC103 OPC Server
- to view the event log file , see Figure 4.3-2
- to clear the log file


OPCS_IEC103_1_Eventlog.txt - Notepad
File Edit Format View Help
Info 2004-06-22 10:35:17.697 Configuration: Shutting down.
Info 2004-06-22 10:35:18.789 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:35:34.321 Device: onReplyReceived:STS != 0 d1cb4a205a01010801e800010600535900000000 2b36
Info 2004-06-22 10:35:34.321 OPCRequest: Request() completed with fail code(80004005)
Info 2004-06-22 10:35:37.416 Configuration: Shutting down.
Info 2004-06-22 10:35:39.589 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:35:42.082 Configuration: Shutting down.
Info 2004-06-22 10:35:42.884 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:35:44.025 Configuration: Shutting down.
Info 2004-06-22 10:35:44.917 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:35:52.347 Configuration: Shutting down.
Info 2004-06-22 10:35:55.842 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:36:09.332 Configuration: Shutting down.
Info 2004-06-22 10:36:12.787 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:36:20.948 Configuration: Shutting down.
Info 2004-06-22 10:36:22.731 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:36:25.495 Configuration: Shutting down.
Info 2004-06-22 10:36:26.997 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:36:28.389 Configuration: Shutting down.
Info 2004-06-22 10:36:29.100 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:36:30.162 Configuration: Shutting down.
Info 2004-06-22 10:36:31.143 EventLog: *** OPCS_IEC103 1.0.107 [2004-05-19 06:29] started ***
Info 2004-06-22 10:36:38.433 Configuration: Shutting down.

Eventlog_103.jpg

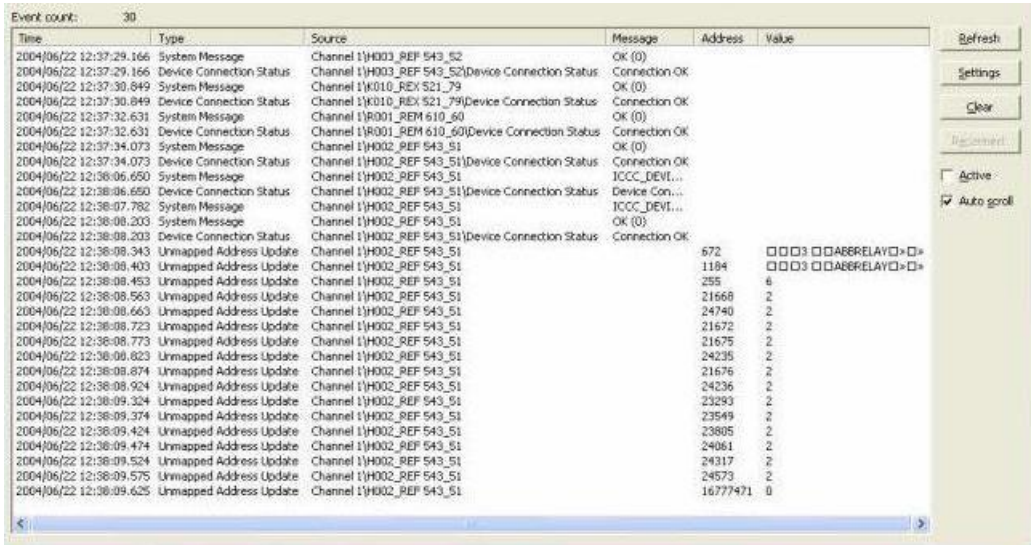
Figure 4.3-2 Event log file

Diagnostic AE Client

Diagnostic events can be monitored and controlled using the Diagnostic AE Client function, see Figure 4.3-3 . Click **Refresh** to update the status information. To be able to receive events from a certain device, diagnostic events must be enabled for this respective device.

To enable diagnostic events:

1. Right-click the device.
2. Select **Online diagnostics**.
3. Mark the Diagnostic events enabled check box. See Figure 4.3-3 for example.


Event count: 30
Time Type Source Message Address Value
2004/06/22 12:37:29.166 System Message Channel 1\H003_REF 543_S2 OK (0)
2004/06/22 12:37:29.166 Device Connection Status Channel 1\H003_REF 543_S2\Device Connection Status Connection OK
2004/06/22 12:37:30.849 System Message Channel 1\K010_REX S21_79 OK (0)
2004/06/22 12:37:30.849 Device Connection Status Channel 1\K010_REX S21_79\Device Connection Status Connection OK
2004/06/22 12:37:32.631 System Message Channel 1\R001_REM 610_60 OK (0)
2004/06/22 12:37:32.631 Device Connection Status Channel 1\R001_REM 610_60\Device Connection Status Connection OK
2004/06/22 12:37:34.073 System Message Channel 1\H002_REF 543_S1 OK (0)
2004/06/22 12:37:34.073 Device Connection Status Channel 1\H002_REF 543_S1\Device Connection Status Connection OK
2004/06/22 12:38:06.650 System Message Channel 1\H002_REF 543_S1 ICCC_DEVI...
2004/06/22 12:38:06.650 Device Connection Status Channel 1\H002_REF 543_S1\Device Con...
2004/06/22 12:38:07.782 System Message Channel 1\H002_REF 543_S1 ICCC_DEVI...
2004/06/22 12:38:08.203 System Message Channel 1\H002_REF 543_S1 OK (0)
2004/06/22 12:38:08.203 Device Connection Status Channel 1\H002_REF 543_S1\Device Connection Status Connection OK
2004/06/22 12:38:08.343 Unmapped Address Update Channel 1\H002_REF 543_S1 672
2004/06/22 12:38:08.403 Unmapped Address Update Channel 1\H002_REF 543_S1 1184
2004/06/22 12:38:08.453 Unmapped Address Update Channel 1\H002_REF 543_S1 255 6
2004/06/22 12:38:08.563 Unmapped Address Update Channel 1\H002_REF 543_S1 21668 2
2004/06/22 12:38:08.663 Unmapped Address Update Channel 1\H002_REF 543_S1 24740 2
2004/06/22 12:38:08.723 Unmapped Address Update Channel 1\H002_REF 543_S1 21672 2
2004/06/22 12:38:08.773 Unmapped Address Update Channel 1\H002_REF 543_S1 21675 2
2004/06/22 12:38:08.823 Unmapped Address Update Channel 1\H002_REF 543_S1 24235 2
2004/06/22 12:38:08.874 Unmapped Address Update Channel 1\H002_REF 543_S1 21676 2
2004/06/22 12:38:08.924 Unmapped Address Update Channel 1\H002_REF 543_S1 24236 2
2004/06/22 12:38:09.324 Unmapped Address Update Channel 1\H002_REF 543_S1 23293 2
2004/06/22 12:38:09.374 Unmapped Address Update Channel 1\H002_REF 543_S1 23549 2
2004/06/22 12:38:09.424 Unmapped Address Update Channel 1\H002_REF 543_S1 23805 2
2004/06/22 12:38:09.474 Unmapped Address Update Channel 1\H002_REF 543_S1 24061 2
2004/06/22 12:38:09.524 Unmapped Address Update Channel 1\H002_REF 543_S1 24317 2
2004/06/22 12:38:09.575 Unmapped Address Update Channel 1\H002_REF 543_S1 24573 2
2004/06/22 12:38:09.625 Unmapped Address Update Channel 1\H002_REF 543_S1 16777471 0
Refresh
Settings
Clear
Reconnect
Active
Auto scroll

IEC103_OPC_Server_Diagnostic_AE_client.jpg

Figure 4.3-3 IEC103 OPC Server Diagnostic AE client

4.4. Monitoring and controlling IEC103 Channel Activity

The IEC103 Channel activity can be monitored with the Online diagnostics function.

You can also take a channel into use or out of use as described in this section.

To monitor and control IEC103 Channel activity:
1. Select the channel you want to monitor in the object tree of SAB600.
2. Right-click the channel.
3. Select **Online diagnostics**.

In the Diagnostic counters field, you can monitor the channel activity. To reset Diagnostic counters, click **Reset counters**.

You can take an IEC103 Channel into use by marking the **In use** check box. If you unmark the check box, the channel is taken out of use. Diagnostic counters are updated every 2 seconds. To update them manually, click **Refresh**.

For more information on the channel online diagnostics with the Analyzer function, see COM600 User's manual.

4.5. Monitoring and controlling IEC103 Device communication

The IEC103 device communication can be monitored with the Online diagnostics function. You can also take a device or module into use or out of use as described in this section.

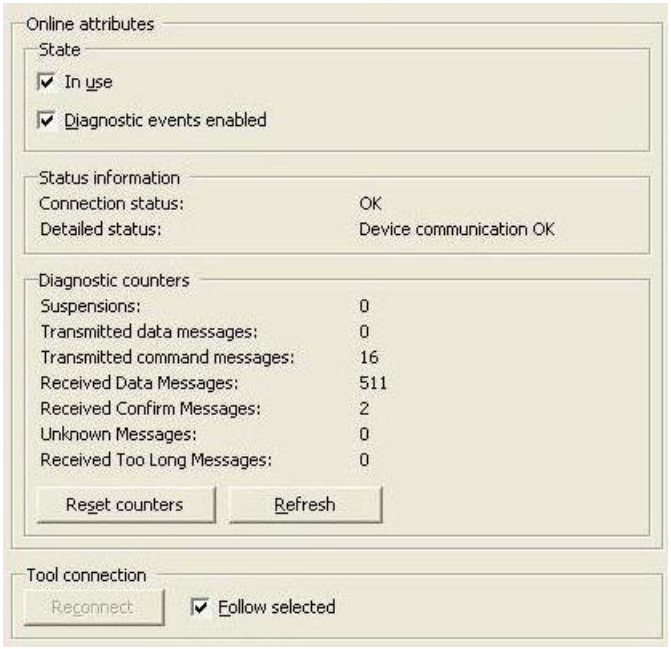
To monitor and control IEC103 Device communication:
1. Select the device/ module you want to monitor in the object tree of SAB600.
2. Right-click the device/module.
3. Select **Online diagnostics**.

In the Status information field, you can monitor the device status.

The Diagnostic counters field provides information on device activity. To reset diagnostic counters, click **Reset counters**.

You can take an IEC103 device into use by marking the **In use** check box. If you unmark the check box, the device is taken out of use.

Diagnostic counters are updated every 2 seconds. To update them manually, click **Refresh**.



IEC103_Device_Online_diagnostics.jpg

Figure 4.5-1 IEC103 Device Online diagnostics

4.6. Data object diagnostics

For information on data object diagnostics, refer to COM600 User’s Manual.

5. Technical reference

5.1. About this section

This section provides reference information about the following issues:
- IEC 61850 data modeling
- Attributes
- Status codes

5.2. IEC 61850 data modeling

5.2.1. General about IEC 61850 data modeling

The relationship between the IEC 61850 data modeling and IEC103 OPC Server is described in this section.

For each data class, there is a table giving a detailed description about the relation between the IEC103 data and IEC 61850 data object attributes and services. The tables also describe how the data is presented on the OPC Server name space.

The columns in the tables have the following content types:
- **Name** specifies the OPC item name of the attribute/service.
- **Type** specifies the IEC 61850 type of the attribute.
- **Value/ Value range** specifies the allowed values and ranges of the attribute/service.
- **Mandatory/Optional** specifies whether the attribute is considered as mandatory or optional according to the IEC 61850 standard.
- **OPC data types** specify the OPC data type used for the OPC item.

5.2.2. Data objects for status information

5.2.2.1. Single point status (SPS)

SPS represents ASDUs 1 and 2.

Table 5.2.2.1-1 Single point status (SPS) information

Name	Type	Value/ Value range	Mandatory /Optional	Protocol information element	OPC data types
stVal	BOOLEAN	TRUE | FALSE	M	DPI (1: OFF, 2: ON)	VT_BOOL
q	Quality		M	Time Validity	VT_I4
t	TimeStamp		M	CP32	VT_DATE

Name	Type	Value/ Value range	Mandatory /Optional	Protocol information element	OPC data types
d	Description	Text	O		VT_BSTR

5.2.2.2. Double point status (DPS)

DPS represents ASDUs 1 and 2.

Table 5.2.2.2-1 Double point status (DPS) information

Name	Type	Value/ Value range	Mandatory/ Optional	Protocol information element	OPC data types
stVal	CPT	Intermediate-state (0) off(1) on(2) bad-state(3)	M	DPI	VT_I4
q	Quality		M	Time Validity	VT_I4
t	TimeStamp	Full_Timestamp	M	CP32	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.2.3. Integer status (INS)

INS represents ASDUs 3, 4 and 9.

Table 5.2.2.3-1 Integer status (INS) information

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
stVal	INTEGER		M	MVAL, SCL	VT_I4
q	Quality		M	ER, OV, time validity	VT_I4
t	TimeStamp		M	CP32	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.2.4. Protection activation information (ACT)

ACT represents ASDUs 1 and 2.

Table 5.2.2.4-1 Proptection activation information (ACT)

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
general	BOOLEAN		M	DPI (1:OFF, 2:ON)	VT_BOOL
phsA	BOOLEAN		O	DPI (1:OFF, 2:ON)	VT_BOOL
phsB	BOOLEAN		O	DPI (1:OFF, 2:ON)	VT_BOOL
phsC	BOOLEAN		O	DPI (1:OFF, 2:ON)	VT_BOOL
neut	BOOLEAN		O	DPI (1:OFF, 2:ON)	VT_BOOL
q	Quality		M	ER, OV, Time Validity IV, NT, SB, BL, OV	VT_I4
t	TimeStamp		M	CP32	
d	Description	Text	O		VT_BSTR

5.2.2.5. Protection activation information (ACD)

ACD is configured the same way as ACT since IEC103 does not support direction information. All direction item tags (dir*) always have the direction value “unknown” and OPC data type VT_I4.

5.2.2.6. Device name plate (DPL)

DPL represents ASDU 5.

Table 5.2.2.6-1 Device name plate (DPL) information

Name	Type	Value/ Value range	Mandat-ory/Optional	Protocol informa-tion element	OPC data types
vendor	VisibleString		M	ASC chars [1...8]	VT_BSTR
hwRev	VisibleString		O		VT_BSTR
swRev	VisibleString		O	ASC chars [9...12]	VT_BSTR
serNum	VisibleString		O		VT_BSTR
location	VisibleString		O		VT_BSTR

5.2.2.7. Logical node name plate (LPL)

LPL represents ASDU 5.

Table 5.2.2.7-1 Logical node name plate (LPL) information

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
vendor	VisibleString		M	ASC chars [1...8]	VT_BSTR
swRev	VisibleString		O	ASC chars [9...12]	VT_BSTR
d	VisibleString		O		VT_BSTR

5.2.3. Data objects for measurand information

5.2.3.1. Measured value (MV)

MV represents ASDUs 3, 4, and 9.

Table 5.2.3.1-1 Measured value (MV) information

Name	Type	Value/Value range	Mandatory/Optional	Protocol information element	OPC data types
mag	AnalogueValue		M	MVAL, SCL	VT_R4
range	Range		O		VT_I4
q	Quality		M	ER, OV, time validity	VT_I4
t	TimeStamp		M	CP32	VT_DATE
rangeC	RangeConfig		O		See RangeConfig
units	Unit		O	Config	See Unit
d	Description	Text	O		VT_BSTR

5.2.3.2. Complex measured value (CMV)

CMV represents ASDUs 3, 4 and 9.

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
cVal.mag	AnalogueValue		M	MVAL, SCL	VT_R4
range	Range		O		VT_I4
q	Quality		M	ER, OV, time validity	VT_I4
t	TimeStamp		M	CP32	VT_DATE
rangeC	RangeConfig		O		
units	Unit		O	Config	

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
d	Description	Text	O		VT_BSTR

5.2.3.3. WYE

WYE represents ASDUs 3, 4 and 9.

Table 5.2.3.3-1 WYE information

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
phsA	CMV		M	See CMV	See CMV
phsB	CMV		O	See CMV	See CMV
phsC	CMV		O	See CMV	See CMV
neut	CMV		O	See CMV	See CMV
d	Description		O	Separate signal	VT_BSTR

5.2.3.4. Delta (DEL)

DEL represents ASDUs 3, 4 and 9.

Table 5.2.3.4-1 Delta (DEL) information

Name	Type	Value/ Value range	Mandatory/Optional	Protocol information element	OPC data types
phsAB	CMV		M	See CMV	See CMV
phsBC	CMV		M	See CMV	See CMV
phsCA	CMV		M	See CMV	See CMV
d	Description	Text	O	Separate signal	VT_BSTR

5.2.4. Data objects for controllable status information

5.2.4.1. Controllable single point (SPC)

SPC represents ASDU 20.

Table 5.2.4.1-1 SPC represents ASDU 20.

Name	Type	Value/Value range	Mandatory/Optional	IEC103 information element	OPC data types
ctlVal	BOOLEAN	FALSE | TRUE	M	DCO (1:OFF, 2:ON)	VT_BOOL

Name	Type	Value/Value range	Mandatory/Optional	IEC103 information element	OPC data types
stVal	BOOLEAN	FALSE | TRUE	M	DPI (1:OFF, 2:ON)	VT_BOOL
q	Quality		M	Time validity	VT_I4
t	TimeStamp		M	CP32	VT_DATE
d	Description	Text	O		VT_BSTR

5.2.4.2. Controllable double point (DPC)

DPC represents ASDU 20.

Table 5.2.4.2-1 DPC represents ASDU 20.

Name	Type	Value/Value range	Mandatory/Optional	IEC103 information element	OPC data types
ctlOperOn	INTEGER	Control value	O	DCO (2:ON)	VT_I4
ctlOperOff	INTEGER	Control value	O	DCO (1:OFF)	VT_I4
ctlSelOn	INTEGER	Control value	O	Simulated	VT_I4
ctlSelOff	INTEGER	Control value	O	Simulated	VT_I4
stVal	ENUMERATED	intermediate-state (0) off (1) on (2) bad-state (3)	M	DPI (1:OFF, 2:ON)	VT_I4
q	Quality		M	Time validity	VT_I4
t	TimeStamp		M	CP32	VT_DATE
ctlCan	INTEGER	Control value	O	Simulated	VT_I4
stSeld	BOOLEAN	FALSE | TRUE	O	Simulated	VT_BOOL
d	Description	Text	O	Config	VT_BSTR

5.2.4.3. Binary controlled step position information (BSC)

BSC represents ASDU 20.

Table 5.2.4.3-1 Binary controlled step position information (BSC)

Name	Type	Value/ Value range	M/O	Protocol information element	OPC data types
ctlVal	ENUMERATED	stop (0) | lower (1) | higher (2) | reserved (3)	M	DCO (1:OFF, 2:ON)	VT_I1
valWTr	ValWithTrans		M		VT_I4
q	Quality		M	Time validity	VT_I4
t	TimeStamp		M	CPT	VT_DATE

Name	Type	Value/ Value range	M/O	Protocol information element	OPC data types
d	Description	Text	O		VT_BSTR

5.3. Attributes

5.3.1. General about attributes

In addition to item tags for process data (indications and commands), the IEC103 OPC Server also provides some item tags for controlling the devices and retrieving status information from them. These item tags are called attributes.

There are several categories of attributes, which are described in the following subsections.

5.3.2. Server attributes

Table 5.3.2-1 Server attributes

Name	Value or Value range/ Default	Description
Protocol stack version	Value: Version information	Data type: Text Access: Read-only Version information of the protocol stack
Reset		The **Reset** button for resetting the OPC Server
File version		File version of the executable OPC Server
Product version		Version information of the installed OPC Server

5.3.3. IEC103 Channel attributes

Table 5.3.3-1 IEC103 channel attributes

Name	Value or Value range/ Default	Description
In use	0 = Not in use, the channel communication is stopped 1 = In use Default: 1	Data type: Integer Access: No limitations The state of the channel - whether it is in use or not. When a channel is not in use, no data can be transmitted on it, and no data is received from it. The channel attributes can be read as usual. Generally, a channel must be taken out of use by setting this attribute to 0 before the channel attributes can be written. When a channel is stopped by setting the IU attribute = 0, all data transmission on the channel ceases. However, before that, the protocol stack executes to the end all ongoing data transactions. For example, the polling of the station in turn is completed.
Modem signal		Data type: Integer Access: Read-only
Clear To Send (CTS)	0 = Passive signal 1 = Active signal	Indicates the state of the Clear To Send (CTS) signal.
Data Carrier Detect (DCD)	0 = Passive signal 1 = Active signal	Indicates the state of the Data Carrier Detect (DCD) signal.
Diagnostic counters		Data type: Integer Access: Read-only
Transmitted telegrams		Incremented each time a message is transmitted to the IEC103 channel by the IEC103 OPC Server.
Failed transmissions		Incremented each time a message transmission to the IEC103 channel fails for some reason.
Transmit timeouts		Incremented each time a transaction based transmission does not receive a response within a configured timeout.
Transmitted commands		Incremented each time a command is transmitted to the IEC103 channel by the IEC103 OPC Server.
Transmitted replies		Incremented each time a reply is transmitted to the IEC103 channel by the IEC103 OPC Server.

Name	Value or Value range/ Default	Description
Received telegrams		Incremented each time a telegram is received by the IEC103 OPC Server from the IEC103 channel.
Parity errors		Incremented each time a parity error is detected in a message received from the IEC103 channel.
Overrun errors		Incremented each time an overrun error is detected in a message received from the IEC103 channel.
Checksum errors		Incremented each time a checksum error is detected in a message received from the IEC103 channel.
Framing errors		Incremented each time a framing error is detected in a message received from the IEC103 channel.
Buffer overflow errors		Incremented each time a buffer overflow occurs in the IEC103 channel.

5.3.4. IEC103 Device attributes

Table 5.3.4-1 IEC103 Device attributes

Name	Value or Value range/ Default	Description
In use	0 = Out of use 1 = In use Default: 1	Data type: Integer Access: No limitations The operational status of the device - in use or out of use. Taking the device out of use with this attribute stops all data communication with the device. All operations that would result in data exchange are disabled. The device itself is not affected by the attribute, only the protocol stack's image of the device. Setting IU to 1 is allowed only if the device address is legal.

Name	Value or Value range/ Default	Description
Object status	1 = Re-transmit system message A status code, for example: 0 = OK (communication works properly) 13863 = Device suspended	Data type: Integer Access: No limitations Indicates the detailed information about the station device status. Writing to the OS attribute (OS = 1) of a device makes the protocol stack to re-transmit the last system message caused by the device. Possible "Stopped" and "Suspended" messages cause old marking of OPC items. By reading the OS attribute, the status code of the system message can be read. See the Status Codes manual for detailed information.
Device connection status	True = Device connection OK False = Device connection suspended	Data type: Boolean Access: Read-only Indicates the status of the device connection.
Diagnostic counters		Data type: Integer Access: Read-only
Suspensions		Incremented each time the communication with the IEC103 device is broken and the device is considered suspended.
Send data messages		Incremented each time a data message is sent.
Send command messages		Incremented each time a command message is sent.
Received data messages		Incremented each time a data message is received.
Received confirmation messages		Incremented each time the device sends a confirmation message to a command.
Unknown messages		Incremented each time an unknown message is received.
Received too long messages		Incremented each time a message exceeding the expected/ allowed maximum length is received.

5.4. Status codes

0 Device OK.

13857	Message buffer full. The value of the Message Length parameter may be too small.
13858	Message filling error. The value of the Message Length parameter may be too small.
13863	Device suspended. The reason could be that the link is not properly established (for example, incorrect communication cable wiring) or the client station does not respond.
13864	Message sending error. The error may be the result of a problem in communication cable wiring or hardware.
13865	Remote device replies with no acknowledged response. The client did not accept the message but responded with a negative acknowledgment instead. Not used in the unbalanced mode.
13866	Link not ready. A message is sent to a link with a non-established communication.
13870	Confirmation timeout. An activation confirmation to a command was not received from the IEC client in the time defined by the Reply Timeout parameter.
13871	Negative confirmation received. The activation confirmation received from the IEC client was negative, that is, the command failed.
13872	Device taken out of use.
13881	Device taken in use.
17600	Remote link continuously busy. The Data Flow Control (DFC) bit of the messages from the client is set for more than 15 s.
17601	Timeout while transmitting. The CTS signal or the end of transmitted message is not received in correct time. The DE attribute controls the CTS waiting time; the transmission time of the message is automatically calculated.
17602	Timeout while waiting for an acknowledgment to a message.
17604	Link not ready. The application level sends a command before the communication between the server and the client is established.
17605	Remote link busy.
17606	Remote link not responding. The server does not receive a reply from the client.
17607	Channel set in use.
17608	Channel set out of use.
17610	Receiver out of buffers.
17611	Dial-up function inactivated.
17612	Dial-up function activated.

Appendix 1

Interoperability list for IEC103 OPC Master

☐ Not supported

■ Supported

▩ Supported, may need additional configuring

Physical layer

Electrical interface

■ EIA RS-485

☐ Number of loads.....for one protection equipment

■ RS-232

EIA RS-485 standard defines unit loads so that 32 of them can be operated on one line. For detailed information, refer to clause 3 of the EIA RS-485 standard.

Optical interface

☐ Glass fibre

☐ Plastic fibre

☐ F-SMA type connector

☐ BFOC/2.5 type connector

■ Depends on tranceiver

Transmission speed

■ 9 600 bit/s

■ 19 200 bit/s

Link layer

There are no choices for the link layer.

Application layer

Transmission mode for application data

Mode 1 (The least significant octet first), as defined in clause 4.10 of IEC 870-5-4, is used exclusively in this companion standard.

Common address of ASDU (system-specific parameter)

- ■ One COMMON ADDRESS OF ASDU (identical with station address)
- ☐ More than one COMMON ADDRESS OF ASDU

Selection of standard information numbers in monitor direction

System functions in monitor direction

- ■ <0> End of general interrogation
- ☐ <0> Time synchronisation
- ☐ <2> Reset FCB
- ☐ <3> Reset CU
- ☐ <4> Start/restart
- ☐ <5> Power on

Status indications in monitor direction

- ■ <16> Auto-recloser active
- ■ <17> Teleprotection active
- ■ <18> Protection active
- ■ <19> LED reset
- ■ <20> Monitor direction blocked
- ■ <21> Test mode
- ■ <22> Local parameter setting
- ■ <23> Characteristic 1
- ■ <24> Characteristic 2
- ■ <25> Characteristic 3
- ■ <26> Characteristic 4
- ■ <27> Auxiliary input 1
- ■ <28> Auxiliary input 2
- ■ <29> Auxiliary input 3
- ■ <30> Auxiliary input 4

Supervision indications in monitor direction

- ■ <32> Measurand supervision I
- ■ <33> Measurand supervision V

- <35> Phase sequence supervision
- <36> Trip circuit supervision
- <37> I>> backup operation
- <38> VT fuse failure
- <39> Teleprotection disturbed
- <46> Group warning
- <47> Group alarm

Earth fault indications in monitor direction

- <48> Earth fault L_1
- <49> Earth fault L_2
- <50> Earth fault L_3
- <51> Earth fault forward, i.e. line
- <52> Earth fault reverse, i.e. busbar

Fault indications in monitor direction

- <64> Start /pick-up L_1
- <65> Start /pick-up L_2
- <66> Start /pick-up L_3
- <67> Start /pick-up N
- <68> General trip
- <69> Trip L_1
- <70> Trip L_2
- <71> Trip L_3
- <72> Trip I>> (backup operation)
- <73> Fault location X in ohms
- <74> Fault forward/line
- <75> Fault reverse/busbar
- <76> Teleprotection signal transmitted
- <77> Teleprotection signal received
- <78> Zone 1
- <79> Zone 2
- <80> Zone 3
- <81> Zone 4
- <82> Zone 5
- <83> Zone 6
- <84> General start/pick-up

- ■ <85> Breaker failure
- ■ <86> Trip measuring system L_1
- ■ <87> Trip measuring system L_2
- ■ <88> Trip measuring system L_3
- ■ <89> Trip measuring system E
- ■ <90> Trip I>
- ■ <91> Trip I>>
- ■ <92> Trip IN>
- ■ <93> Trip IN>>

Auto-reclosure indications in monitor direction

- ■ <128> CB 'on' by AR
- ■ <129> CB 'on' by long-time AR
- ■ <130> AR blocked

Measurands in monitor direction

- ■ <144> Measurand I
- ■ <145> Measurands I, V
- ■ <146> Measurands I, V, P, Q
- ■ <147> Measurands I_N, V_{EN}
- ■ <148> Measurands $I_{L1,2,3}$, $V_{L1,2,3}$, P, Q, f

Generic functions in monitor direction

- ☐ <240> Read headings of all the defined groups
- ☐ <241> Read values or attributes of all the entries of one group
- ☐ <243> Read directory of a single entry
- ☐ <244> Read value or attribute of a single entry
- ☐ <245> End of general interrogation of generic data
- ☐ <249> Write entry with confirmation
- ☐ <250> Write entry with execution
- ☐ <251> Write entry aborted

Selection of standard information numbers in control direction

System functions in control direction

- ■ <0> Initiation of general interrogation
- ■ <0> Time synchronisation

General commands in control direction

- ■ <16> Auto-recloser on/off
- ■ <17> Teleprotection on/off
- ■ <18> Protection on/off
- ■ <19> LED reset
- ■ <23> Activate characteristic 1
- ■ <24> Activate characteristic 2
- ■ <25> Activate characteristic 3
- ■ <26> Activate characteristic 4

Generic functions in control direction

- ☐ <240> Read headings of all the defined groups
- ☐ <241> Read values or attributes of all the entries of one group
- ☐ <243> Read directory of a single entry
- ☐ <244> Read value or attribute of a single entry
- ☐ <245> General interrogation of generic data
- ☐ <248> Write entry
- ☐ <249> Write entry with confirmation
- ☐ <250> Write entry with execution
- ☐ <251> Write entry abort

Basic application functions

- ☐ Test mode
- ■ Blocking of monitor direction
- ☐ Disturbance data
- ☐ Generic services
- ■ Private data

Miscellaneous

Measurands are transmitted with ASDU 3, as well as with ASDU 9. The maximum MVAL can either be 1.2 or 2.4 times the rated value. No different rating shall be used in ASDU 3 and ASDU 9, since there is only one choice for each measurand.

Measurand	**Max. MVAL = 1.2 or times the rated value**	**Max. MVAL = 2.4 times the rated value**
Current L_1	■	■

Current L_2	■	■
Current L_3	■	■
Voltage L_{1-E}	■	■
Voltage L_{2-E}	■	■
Voltage L_{3-E}	■	■
Active power P	■	■
Reactive power Q	■	■
Frequency f	■	■
Voltage L_1 - L_2	■	■

Index

A

adding
channel object 18
Data object 19
device object 18
Gateway object 18
Logical Device object 19
Logical node 19
OPC Server object 18
attributes
channel 49
device 50
server 48

B

Binary controlled step position information (BSC)
IEC 61850 data modeling 47
properties 36

C

channel
attributes 49
diagnostics 40
properties 21
channel object
adding 18
Complex measured value (CMV)
IEC 61850 data modeling 45
properties 30
configuring
object 19
Controllable double point (DPC)
IEC 61850 data modeling 47
properties 35
Controllable single point (SPC)
IEC 61850 data modeling 46
properties 34

D

Data object
adding 19
data object

diagnostics 41
Delta (DEL)
IEC 61850 data modeling 46
properties 32
device
attributes 50
properties 23
device communication
monitoring and controlling 40
Device name plate (DPL)
IEC 61850 data modeling 44
properties 28
device object
adding 18
diagnostics
channel 40
server 38
Directional protection activation information (ACD)
properties 27
Double point status (DPS)
IEC 61850 data modeling 43
properties 25

F

features
OPC Server 14

G

Gateway object
adding 18

I

IEC 61850 data modeling
Binary controlled step position information (BSC) 47
Complex measured value (CMV) 45
Controllable single point (SPC) 46
Delta (DEL) 46
Device name plate (DPL) 44
Double point status (DPS) 43
Integer status (INS) 43
Logical node name plate (LPL) 44
Measured value (MV) 45
Protection activation information (ACD) 44
Protection activation information (ACT) 43
Single point status (SPS) 42
WYE 46
Integer status (INS)

properties 25

L

Logical Device object
adding 19
Logical node
adding 19
Logical node name plate (LPL)
IEC 61850 data modeling 44
properties 29

M

Measured value (MV)
IEC 61850 data modeling 45
properties 30

O

object
configuring 19
object tree
building 17
OPC Server
features 14
properties 20
OPC Server object
adding 18

P

properties
Binary controlled step position information (BSC) 36
channel 21
Complex measured value (CMV) 30
Controllable double point (DPC) 35
Controllable single point (SPC) 34
Delta (DEL) 32
device 23
Device name plate (DPL) 28
Directional protection activation information (ACD) 27
Double point status (DPS) 25
Integer status (INS) 25
Logical node name plate (LPL) 29
Measured value (MV) 30
OPC Server 20
Protection activation information (ACT) 26
Single point status (SPS) 24
WYE 31

Protection activation information (ACD)
IEC 61850 data modeling 44
Protection activation information (ACT)
IEC 61850 data modeling 43
properties 26

S

server
attributes 48
diagnostics 38
Single point status (SPS)
IEC 61850 data modeling 42
properties 24

W

WYE
IEC 61850 data modeling 46
properties 31

Contact us

ABB Oy
Distribution Automation
P.O. Box 699
FI-65101 VAASA, FINLAND
Tel. +358 10 22 11
Fax. +358 10 224 1094

ABB Inc.
Distribution Automation
655 Century Point
Lake Mary, FL 32746, USA
Tel: +1 407 732 2000
Fax: +1 407 732 2335

www.abb.com/substationautomation

1MRS752278 H/31.5.2012 © Copyright 2011 ABB. All rights reserved.

Power and productivity
for a better world™